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A KEY TO THE NORTH AMERICAN SPECIES OF AESHNA FOUND NORTH OF MEXICO.

BY E. M. WALKER, TORONTO.

Although nearly two years have elapsed since the writer commenced a critical study of the North American species of the Odonate genus *Aeshna*, Fabr., it will be some time yet before the work is completed. This delay has been chiefly due to the length of time required for the execution of the numerous illustrations and for obtaining a proper field knowledge of the various species, and also to difficulties experienced in collecting and rearing the nymphs.

This being the case, it was decided to issue in advance an analytical key to the species treated in the revision in order that, in the interval, species may be listed or otherwise referred to under the names employed therein.

It has been necessary to draw up a separate key for the determination of the females, as the chief diagnostic characters of the males are found in the superior appendages and accessory genitalia. This key to the females is largely artificial, and it has been very difficult to find reliable characters for the separation of some of the species, although with experience they can almost always be recognized at a glance. Of some of the species I have seen very few females, and it is very probable that with sufficient material some of the characters used will prove invalid.

A few of the terms employed in the key require special notice. The terms hamular process and hamular fold designate respectively the more superficial and deeper parts of the anterior hamules, and are sufficiently well indicated in figs. 2 and 3 on the plate.

As the colour pattern is of the same type throughout the genus as represented in North America, it has been found convenient to apply special names to the different bands and spots which characterize this pattern.

The name dorsal thoracic band requires no explanation. The first and second lateral thoracic bands are two oblique pale bands on the sides of the mesepimeron and metepimeron respectively. The names used to

designate the abdominal spots are given in the explanation of the plate, and in the key these are referred to under the same abbreviations as are used to indicate them on the plate.

KEY TO THE NORTH AMERICAN SPECIES OF AESHNA.

1. Males.

- A. Anal triangle 3-celled ; spine of the anterior lamina well developed, directed caudad and curved more or less cephalad.
- B. A distinct spinulose ventral tubercle on abd. seg. 1; dorsum of seg. 10 with a median basal tooth-like elevation ; superior appendages with a well-developed superior carina.
- C. A black line on the fronto-nasal suture ; superior appendages not apically forked, the apices obtusangulate or rounded ; superior carina not angulate nor denticulate : inferior appendage somewhat less than half as long as the superiors *i. californica* Calvert.
- CC. No black line on the fronto-nasal suture ; superior appendages in profile apically forked, the apices acute and decurved, superior carina angulate ; inferior appendage distinctly more than half as long as the superiors (*multicolor* group).
- D. Abdomen (excl. appendages) nearly or quite four times as long as the thorax (excl. prothorax) ; ventral tubercle on seg. 1 but little elevated ; superior appendages about five times as long as their greatest width, inferior subbasal tubercle at one-sixth to one-seventh the length of the appendage ; height of superior carina above outer margin, in profile, much less than depth of appendage directly below it, its length rather less than one-third that of the appendage ;

outer side of anal loop in hind wings about as long as inner side of triangle 2. *mutata* Hagen.

DD. Abdomen (excl. appendages) less than three and one-half times as long as thorax ; a prominent ventral tubercle on seg. 1 ; superior appendages about seven times as long as their greatest width, inferior subbasal tubercle at one-fourth to one-fifth the length of the appendage ; height of superior carina above outer margin, in profile, not less than depth of appendage directly below it, its length distinctly more than one-third that of the appendage ; outer side of anal loop in hind wings longer than inner side of triangle 3. *multicolor* Hagen.

BB. Abdominal seg. 1 without a ventral tubercle ; segment 10 without a median dorsal tooth ; superior appendages without a superior carina, not apically forked, but with an antepical inferior spine, the apices broad and rounded (*cyanea* group).

E. A black line (rarely absent) on the fronto-nasal suture ; face pale yellowish ; dorsal thoracic bands 1 mm. or less broad, tapering somewhat towards each end, or sometimes suddenly expanded at the extreme posterior end ; lateral thoracic bands nearly straight and equal ; spots on abdomen blue, of moderate or large size, PD on seg. 9 distinctly more than one-half as long as the dorsum of the segment ; lateral carina of seg. 7 in ventral view slightly or not at all sinuate ; generally one cell between A_1 , at its origin and the anal triangle 4. *palmata* Hagen.

EE. No black line on the fronto-nasal suture ; dorsal thoracic bands rapidly widening caudad so as to be triangular in form with the base just in front of the antealar sinus ; generally two cells between A_1 , at its origin, and the anal triangle.

F. Face rather dark olivaceous ; lateral thoracic bands rather narrow (about 1 mm.), straight, not widening above, nearly surrounded by a margin darker than the ground colour of the thorax ; abdominal spots mostly smaller than usual, more or less greenish, PD on seg. 9 less than one-third as long as the dorsum of the segment ; a pair of large pale bluish basal spots on the ventral surface of segs. 4, 5 and 6 ; lateral carina of segs. 7 and 8 in ventral view strongly sinuate in its anterior two-fifths . . . 5. *umbrosa*, n. sp.

FF. Face pale greenish-yellow ; lateral thoracic bands broader, not surrounded by a dark margin, widening above the middle margins of the first band, especially the anterior, distinctly sinuate ; spots of the abdomen well developed, mostly blue, PD on seg. 9 more than one-half as long as the dorsum of the segment ; ventral surface of abdomen without pale spots ; lateral carina of seg. 7 at most very feebly sinuate in ventral view 6. *constricta* Say.

AA. Anal triangle 2-celled ; spine of the anterior lamina directed ventrad.

G. Hamular process continuous with hamular fold (Pl. X, fig. 3), spine of the anterior lamina short and blunt, projecting very little, if at all, below the general level of the ventral surface (*clepsydra* group).

H. A black line on the fronto-nasal suture ; hamular processes short and broad, directed mediad and ventrad.

I. Lateral thoracic bands each divided into a superior and inferior spot ; dorsal thoracic bands reduced to a pair of small elongate spots narrowed at both ends and not reaching the antealar sinus ; superior appendages with the inner margin distinctly sinuate in dorsal view, the apices rounded or bluntly angulate, seldom with a terminal tooth, superior carina minutely denticulated or smooth 7. *interrupta*, n. sp.

II. Lateral thoracic bands not divided.

J. Dorsal thoracic bands reduced to a pair of small pale, often almost obsolete, streaks, which do not nearly reach the antealar sinus ; lateral thoracic bands not more than 1 mm. broad, nearly or quite straight.

K. Superior appendages with a low basal tubercle on the ventro-internal surface (best seen in an oblique view from above) ; inner margin in dorsal view gently sinuate, in profile slightly concave before the middle, beyond which it forms a prominent more or less obtusangulate inferior carina ; breadth at middle about twice that of the extreme base, thence narrowing gradually to the more or less acute apices, which terminate in a small spine ; superior carina moderately elevated before the apex, with a few minute denticles ; inferior appendage about three-fifths as long as the superiors ; lateral thoracic bands about 1 mm. broad below, narrower above 8. *interna*, n. sp.

KK. Superior appendages without any indication of a ventro-internal basal tubercle.

- L. Lateral thoracic bands linear, their breadth less than .75 mm.; inner margin of superior appendages in dorsal view very gently sinuate, in profile straight or slightly convex before the middle, the inferior carina rather low, its angle rounded or obsolete; breadth of appendage at middle scarcely twice that at the extreme base, thence narrowing gradually to the rounded or bluntly angulate apices, which do not normally bear a terminal tooth; superior carina but little elevated, finely denticulated or smooth; inferior appendage three-fifths to two-thirds as long as the superiors 9. *lineata*, n. sp.
- LL. Lateral thoracic bands about 1 mm. broad near the lower end, somewhat narrowed at the middle; inner margin of superior appendages in profile slightly concave before the middle, in dorsal view strongly sinuate, the breadth of the appendage increasing rapidly from the basal fourth, so that at the middle it is fully twice as broad as at base, thence scarcely narrowing to the well-rounded apices, which bear near the outer margin a prominent tooth; inferior appendage slightly more than half as long as the superiors . . . 10. *nevadensis*, n. sp.
- JJ. Dorsal thoracic bands well developed, expanded and truncate at the upper end, which is just in

front of the antealar sinus; lateral thoracic bands more than 1.5 mm. broad, the first band deeply sinuate in front, the second more or less triangular.

M. Hind wing 43-48 mm.; no antehumeral spot; upper end of first lateral thoracic band not bent forwards; spots between first and second bands small and inconspicuous; superior appendages expanding almost symmetrically from the base; the inner margin in dorsal view not sinuate, apices rounded, normally without a terminal spine; outer margin in profile curved or bent upwards, both cephalad and caudad; superior carina rather strongly elevated in the apical fourth, bearing 6 or 8 well-marked denticles. 11. *eremita* Scudd.

MM. Hind wing 39-42 mm.; a large triangular antehumeral spot immediately in front of the inferior part of the first lateral thoracic band, the upper and narrower end of which is bent sharply forward; spots between first and second lateral bands unusually large; superior appendages expanding unsymmetrically, the inner margin being distinctly sinuate, the distal three-fifths equal, apices tapering rather abruptly and terminating in a well-marked slightly decurved spine; outer margin in profile nearly straight throughout; superior carina slightly elevated apically, bearing 3 to 5 small denticles. 12. *clepsydra* Say.

HH. No black line on the fronto-nasal suture.

N. First lateral thoracic band not tapering regularly dorsad, its anterior margin distinctly, usually strongly, sinuate; PD always present on abdominal seg. 10; superior appendages without a prominent inferior basal tubercle.

- O. Larger and relatively stouter species (abdomen 49-55 mm., hind wing 43-48 mm.); lateral thoracic bands blue, sometimes partly green, the anterior margin of the first band very deeply sinuate or angularly excavated; superior appendages expanding almost symmetrically from the base, the inner margin in dorsal view not sinuate, apices normally rounded, not at all decurved, and without a terminal spine; superior carina rather strongly elevated in the apical fourth, bearing 6 or 8 well-marked denticles; a low rounded subbasal inferior eminence present; hamular processes directed mediad, short and broad, with a slender apical tubercle 11. *eremita* Scudd.
- OO. Smaller and slenderer species (abdomen 42-45 mm., hind wing 39-42.5 mm.); superior appendages expanding unsymmetrically from the base, the inner margin in dorsal view distinctly sinuate; superior carina moderately elevated, apices acute, somewhat decurved, with a distinct terminal spine.
- P. Lateral thoracic bands blue or green, the first generally green below, blue above, its anterior margin almost rectangularly sinuate; superior carina of the superior appendages with a few denticles, apices rather abruptly decurved; hamular processes rather long, directed cephalad, subparallel, with the tips somewhat convergent; PL typically represented on abdominal segments 2-6 13. *canadensis*, n. sp.
- PP. Lateral thoracic bands yellowish-green, the anterior margin of the first obtus-angularly sinuate; superior carina of

the superior appendages not denticulated, apices gently decurved; hamular processes directed mediad and ventrad, each consisting of a stout proximal and a slender distal part; PL typically represented on abdominal segs. 2-4 14. *verticalis* Hagen.

NN. First lateral thoracic band tapering regularly dorsad, its margins nearly straight; abdominal seg. 10 without pale spots; superior appendages with a prominent inferior basal tubercle, expanding unsymmetrically from the base, the inner margin in dorsal vein distinctly sinuate; superior carina moderately elevated, not denticulated, the apices rounded, with a small terminal spine 15. *tuberculifera*, n. sp.

GG. Hamular process separate from the hamular fold (pl. X, fig. 4); spine of the anterior lamina long, generally sharp-pointed, projecting well below the general level of the ventral surface; a black line always present on the fronto-nasal suture.

Q. Lateral thoracic bands more than 1 mm. broad, not sigmoid; hamular processes long, slender and spine-like, directed ventrad and mediad; superior carina of the superior appendages not denticulated, apices acute (*juncea* group).

R. Lateral thoracic bands straight and subequal; hamular folds fairly well developed, widely separated, plainly visible in a vertical view from beneath 16. *juncea* L.

RR. Lateral thoracic bands with the anterior margins obtusangularly excavated, the first band slightly bent a little above the middle; hamular folds very small, less widely separated, and almost concealed in a vertical view from beneath by the overlapping hamular processes 17. *subarctica*, n. sp.

QQ. Lateral thoracic bands less than 1 mm. broad, the first one sigmoid or bent by alternate angles; hamular processes broad, flat, triangular, with the inner margins

closely approximate, the apices directed cephalad; superior carina of the superior appendages more or less denticulated (*caerulea* group).

S. Spine of the anterior lamina distinctly longer than the hamular processes, slender, curved ventrad, sharp pointed; distance from hind margin of occiput to frontal vesicle 2.5 mm.; MD small, triangular, yellowish 18. *sitchensis* Hagen.

SS. Spine of the anterior lamina not longer than the hamular processes, rather stout, straight, bluntly-pointed; distance from hind margin of occiput to frontal vesicle less than 2 mm.; MD large, subquadrate, more or less

bluish 19. *septentrionalis* Hagen.

2. Females.

A. Abdominal segment 1 with a distinct ventral spinulose tubercle.

B. A black line on the fronto-nasal suture; length of abdomen (excl. appendages) 36-38 mm 1. *californica* Calvert.

BB. No black line on the fronto-nasal suture; length of abdomen more than 40 mm.

C. Abdomen about four times as long as the thorax (excl. prothorax); ventral tubercle on seg. 1 but little elevated; appendages 7 mm. long, lateral thoracic bands widening above; A_2 arising opposite or distal to the last cubito-anal cross-vein before the subtriangle; outer side of anal loop of hind wing about as long as inner side of triangle 2. *mutata* Hagen.

CC. Abdomen less than four times as long as the thorax; a prominent ventral tubercle on seg. 1; appendages 5-6 mm. long, lateral thoracic bands subequal; A_2 arising proximal to the last cubito-anal cross-vein before the subtriangle; outer side of anal loop of hind wing longer than inner side of triangle 3. *multicolor* Hagen.

AA. Abdominal segment 1 without a ventral spinulose tubercle.

D. Basal plate of ovipositor not bilobed, posterior margin straight or slightly convex; PL generally connected with PD on abdominal segs. 2-4 (often separate in *Ae. umbrosa*), usually smaller than the latter.

- E. Genital valves 4 mm. or more in length; valvular processes as long as dorsum of seg. 10 (2 mm.); appendages rarely less than 2 mm. broad; proximal third broad with convex margins, expanding rapidly, so that the greatest breadth is reached before the middle, distal half gradually tapering to a more or less acute apex; no black line on the fronto-nasal suture.
- F. First lateral thoracic band with the front margin distinctly sinuate, the upper end giving off caudad a small spur; second band suddenly expanding at upper end; length of abdomen without appendages less than 45 mm., of ovipositor 6 mm., of appendages 6-7.5 mm.; apices acute 6. *constricta* Say.
- FF. First lateral thoracic band with the front margin straight, or nearly so, gradually tapering dorsad, not giving off a distinct posterior spur; second band not suddenly widened above; length of abdomen 45 mm. or more, of ovipositor rather less than 5 mm., of appendages 7.5-9.5 mm.; apices acute or somewhat rounded. 15. *tuberculifera*, n.sp.
- EE. Genital valves less than 4 mm. long; valvular processes much shorter than dorsum of 10; appendages less than 2 mm. broad and, except in *Ae. sitchensis*, slender, the margins nearly straight in the proximal third, broadest beyond the middle, the apices rounded.
- G. Abdomen at least 40 mm. long; first lateral thoracic band never sigmoid nor bent by alternate angles.
- H. A black line on the fronto-nasal suture.
- I. Lateral thoracic bands each divided or very nearly divided into a superior and an inferior spot. . . . 7. *interrupta*, n. sp.
- II. Lateral thoracic bands entire.
- J. Lateral thoracic bands nearly straight, the anterior margin of the first band not distinctly sinuate.

- K. Lateral thoracic bands somewhat more than 1 mm. broad, yellow; ovipositor 4 mm. long; genital valves with tips elevated . . . 4. *palmata* Hagen.
- KK. Lateral thoracic bands not more than 1 mm. broad, generally pale bluish, rarely yellow; ovipositor 3.3 mm. long; tips of genital valves not elevated.
- L. Lateral thoracic bands about 1 mm. broad . . .
8. *interna*, n. sp.
- LL. Lateral thoracic bands linear, generally less than .75 mm. broad . . .
9. *lineata*, n. sp.
- JJ. Lateral thoracic bands broad, the first with the anterior margin strongly sinuate, narrowed about the middle, the second expanding dorsad, more or less triangular.
- M. Larger, stouter species; hind wing 45-46.5 mm. long; no antehumeral spot; first lateral thoracic band greatly constricted near the middle by a deep excavation of the anterior margin, upper end not bent forwards; spots between first and second bands small and inconspicuous 11. *eremita* Scudd.
- MM. Smaller, slenderer species; hind wing 40-42 mm. long; a conspicuous triangular pale antehumeral spot just in front

of the lower and broader part of the first lateral band, the upper end of the latter narrow and sharply bent forward; a large pale spot, including the spiracle, and another above

it 12. *clepsydra* Say.

HH. No black line on the fronto-nasal suture.

N. Lateral thoracic green or yellowish-green (rarely blue) not margined with black, the anterior margin of the first band distinctly sinuate, the second band elongate triangular; PD on 2-5 at least 1 mm. long; ovipositor 3 mm. long; tips of genital valves not elevated.

O. First lateral thoracic band with the anterior margin almost rectangularly sinuate, its upper end giving off caudad a very narrow spur; posterior (postero-inferior) margin of second band generally curved ventrad at the upper end; appendages usually 5-6 mm. long (rarely 6.7

mm) 13. *canadensis*, n. sp.

OO. First lateral thoracic band with the anterior margin obtusangularly sinuate, its upper end giving off caudad a rather broad spur; posterior margin of second lateral band straight; appendages 7 mm. long 14. *verticalis* Hagen.

NN. Lateral thoracic bands bright yellow, margined with black or dark brown, about 1 mm broad, straight, the first band expanded a little below, but not at all sinuate, the second band with the margins subparallel; abdominal spots

- small, PD being on all the segments less than .5 mm. long; ovipositor 3.5 mm.; tips of genital valves elevated 5. *umbrosa*, n. sp.
- GG. Abdomen not more than 38 mm. long; first lateral thoracic band narrow, sigmoid, or bent by alternate angles; a heavy black line on the fronto-nasal suture.
- P. Distance from posterior margin of occiput to frontal vesicle at least 2.5 mm.; appendages slightly longer than the dorsa of segs. 9 + 10, a little more than 1 mm. broad, tapering equally at base and apex, the latter distinctly though bluntly pointed. 18. *sitchensis* Hagen.
- PP. Distance from posterior margin of occiput to frontal vesicle about 1.5 mm.; appendages about as long as segs. 9 + 10; more slender proximally than distally, the apices rounded or broadly and obscurely pointed 19. *septentrionalis* Hagen.
- DD. Basal plate of ovipositor distinctly bilobed (pl. X, fig. 5); PL separate from PD (sometimes narrowly connected on seg. 2), as large as the latter on segs. 2-5; a black line always present on the fronto-nasal suture; lateral thoracic bands yellow or greenish-yellow.
- Q. Appendages distinctly shorter than segs. 8 + 9 (5 mm. or less); margins of lateral thoracic bands nearly straight, first band gradually tapering to the upper end, without a distinct posterior spur 16. *juncea* L.
- QQ. Appendages about as long as segs. 8 + 9 (6-6.5 mm.); lateral thoracic bands with their anterior margins obtus-angularly excavated, but not sinuate, posterior margins nearly straight; first band gently widening above the middle to the upper end, from which a narrow posterior spur is given off. 17. *subarctica*, n. sp.
- Unknown 10. *nevadensis*, n. sp.

EXPLANATION OF PLATE.

- Fig. 1, 2. *Aeshna juncea* L. ♂, abdominal segments 1-4. 1, lateral; 2, dorsal view.
 D, dorsal spot of segment 1.
 L, lateral " "
 AL, anterior lateral spot.
 ML, middle " "
 PL, posterior " "
 AML, the homologue of AL + ML on seg. 2.
 AD, anterior dorsal spot.
 MD, middle " "
 PD, posterior " "
- " 3. *Aeshna interrupta* Walk. ♂, anterior hamules.
 HF, hamular fold; HP, hamular process; Sp., spine of the anterior lamina.
- " 4. *Aeshna juncea* L. ♂. Letters as in Fig. 3.
- " 5. *Aeshna juncea* L. ♀, ventral aspect of abdominal segments 9 and 10; Ov, ovipositor; BO, basal plate of ovipositor; GV, genital valve; VP, valvular process; Ap., appendage.
 (To be continued.)

NOTES ON SOME SOCIETY ISLAND MOSQUITOES.

BY R. W. DOANE, STANFORD UNIVERSITY, CALIF.

During a short stay in July and August on Tahiti, Morea and Tetioroa I found the mosquitoes very troublesome, particularly so in the dense growth where one could not get the sea breeze. I had not time to make any particular study of the species occurring there, but the following notes on the three species that I met with may be acceptable to those interested in the group.

Stegomyia calopus, Meig., and *S. scutellaris*, Walk., are the two common day mosquitoes, occurring in the houses and out of doors everywhere. They breed together in standing, sometimes rather foul, water. I have seen the larvæ by the millions in the small drainage gutters along the streets of Papetee. No effort is made to control them, although one man told me that at some seasons the mosquitoes were so bad in places that people took refuge in their beds to escape the pests. All the beds are provided with a canopy of mosquito netting, but there are no screens on the doors or windows.

With the opening of the Panama Canal and the consequent short and frequent passage of ships from that region to all of these Pacific islands,